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22
A VIEW

OF THE PREVAILING

Theories of Inflammation;

SUBMITTED TO THE CONSIDERATION OF THE

Honourable Robert Smith, Provost,

AND THE REGENTS

OF THE

UNIVERSITY OF MARYLAND.

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TO NATHANIEL POTTER, M. D.
PROFESSOR OF THE PRACTICE OF MEDICINE
IN THE
UNIVERSITY OF MARYLAND,

The following essay is most respectfully inscribed as a tribute of sincere respect for the many and valuable favours received by the author while prosecuting his professional pursuits under his able guidance.

INTRODUCTION.

MEDICAL opinion had found a common level, and the spirit of enquiry, destitute of an object, had been dozing for years, when the Harveian tide burst upon the world. The curious fabrics of medical philosophy reared with care, and consecrated by time, ingeniously contrived, and fancifully adorned, possessed no principle of intrinsic gravity which could resist the impetuous flood. They were shaken from their centre, overturned, and engulfed. In this wreck perished the Humoral doctrines of medicine. The monuments and records of past ages were swept away, and a new surface presented, for the more correct inscription of the laws and purposes of the human body. Happily for science and humanity, the opportunity was not lost. The work of improvement, though slow, has been progressive.

From this important era may be dated the fortunate commutation of the ground of physical enquiry in medicine.* A more just relation of attributes has been deduced from a more correct acquaintance with the harmony of structure. And the purposes and conditions of the living body in health and disease, traced to agencies and modes more elevated and respectable, than mechanic principles, and hydraulic laws.

* The Humoral doctrines of physic were not immediately abandoned. They survived for a time, the improvement of general science, bottomed on the inferences of anatomical discovery. But from the period to which we refer, their footing became insecure.

Though the mists of obscurity are becoming every day more dense around the errors of past time; and we look in vain for more than casual truth, through a mass of opinion which has been rapidly increasing since man possessed the instruments for its record, it is pleasant and not useless, to review the various modes which ingenuity has devised for the accomplishment of this great aim. For that truth was the object of our predecessors in this walk, we cannot doubt; and when we assert, that but a casual ray lighted their footsteps, we do not mean to plunder them of the merit to which they have a claim. On the score of industry in research, a more enlightened age must yield them the palm. It is rather with the interest of the advocate than the austerity of the judge, we revert to their pretensions. While they were ignorant of principles, they were not inobservant of facts, and noted correctly, what they erred in explaining. Had they not failed here, they would have effected what is rarely accomplished. They would have outstripped the science of the period in which they lived. We must look to the subsequent discovery of the circulation, and the astonishing progress of chemistry, for the improvement of our science. As it is to them we are indebted for our only true knowledge of the relation between the agency of natural laws, and the phenomena of animal life. The sole source of correct opinion in physic. From the first we derive our acquaintance with natural powers; from the latter our chief knowledge of natural agents.

It is not then from feelings of unmanly hostility to opinions which we consider fairly controverted, and holding no longer a ground of de-

fence, that we engage in a retrospect of what those opinions were. Nor is it from motives of curiosity alone that we prosecute such a review. From the closeness and industry of research, for which some of the ancients are remarkable, we meet in their writings with much fidelity of observation, and considerable ingenuity in the deductions they have attempted to establish. A glimmering of light occasionally broke in upon their labours, and in their efforts to trace its source, they made indirectly one step towards its discovery, by affording to their successors a warning, how, and where, they had failed. They also detailed effects with a minuteness and accuracy, which obviated every difficulty in this respect to those who came after them; and by the extent and variety of their conjectures as to cause, furnished hints which modern commentators have appropriated to their use, and by a dextrous management of them have built up theories for which they arrogate reputation, while they are disingenuously silent about the debts they have contracted. Although it is no more than a dextrous management of specious errors, adopted from the suggestions of others, it is one purpose of this review, occasionally to restore to the right owner, what has been borrowed without acknowledgment.

THEORIES OF INFLAMMATION.

HARVEY's discovery was particularly adverse to the dominant opinions on the subject we are about to discuss; the existing Theories of Inflammation. Previous to that event all inflammations were supposed to consist in *Fluxions* and *Congestion*. From both causes the same effect ensued, viz: *obstruction*. And the two terms, which have in fact a common meaning, were adopted as significant in the understanding of their authors, of the mode by which the consequence was produced. Inflammation, from *Fluxion*, consisted in the flow of humors into a part they did not naturally occupy, and the inflammation was either simple, or received a specific appellation, as those humors were supposed to be natural, or charged with some foreign and noxious matter. *Congestion* was the imaginary stagnation of the natural humors of a part.

Such were the general principles, the primary divisions of their theories of inflammation. A few trifling subdivisions were marked out; but to those two genera were referred all their reasoning upon the subject: all their discussions about the cause and cure of inflammation. The natural or contingent qualities attributed to the humors, the immediate consequences of their detention in a part, and the consecutive changes resulting from their seclusion and confinement, were the data by which were illustrated the condition of the part, and the phenomena of the disease.

Those sentiments were grounded on the prevailing theories of physic. The blood and humors were supposed to have a diurnal revolution; their source and receptacle being in the liver. From this rendezvous they went abroad into the body in the day, and to it they returned at night. Let us not censure the authors of such opin-

ions hastily. Before the true mode of circulation was discovered, nothing could be known on this subject.

As obstruction constituted the prominent feature in all the conditions of inflammation, and as mischief in a greater or less degree, consistent with the nature and properties of the contained fluid, must result from its remora in the part, we have a constant regard paid to the necessity for its removal, and some ingenuity in the means devised for its accomplishment. There was at least a harmony between the ideas entertained of the nature of the disease, with the manner of its production, and the modes by which its removal was attempted. The fluids being subjected by the distributive powers to but slow and feeble motion, except when those powers were excited by extraordinary agency or stimulus, it was supposed that their current might be easily changed. This opinion applied to the doctrine of *Fluxions*, established a maxim, that when inflammation was the consequence of an increased flow or determination of humors to a part, *Revulsion*, or a change in their distribution was necessary, and might be effected by inviting a flux to some other part. Bloodletting at a distance from the seat of disease, was the plan adopted for this purpose: as they hoped in that way to produce a counter current or drain which would avert injury from the part threatened. In *Congestions* they had recourse to repellents and discutients. Articles externally applied possessing a supposititious power of dislodging the confined humours, or bringing them into a condition favourable to their escape by transpiration. When the inflammation resisted all those means, the plan was changed; and they then talked about promoting concoction, suppuration, mundification, incarnation and cicatrization. To each of those objects they adapted specific materials, formulas and management. Producing an inflamed condition in some less dangerous part than the original seat of disease, was another mode of treatment, in which much confidence was reposed. Great faith being cherished in the *attractive* power of local disease.

Time has not completely obliterated a partiality for some of the inventions to which those doctrines gave rise. A farrago of applications, a medley of poultices, baths,

fomentations, &c. still encumber this department of the practice of physic and surgery. Fooleries for the most part by which science is clogged and degraded; and from which it cannot escape until man will consent to believe that there is a wisdom in the structure of the body, and the appointment of its laws, superior to his cunning and art in supplying its wants.

Having contemplated for the present but a general and brief summary of old opinions on inflammation, and intending to make their authors speak for themselves, as fairly and fully as our investigation and understanding of them will permit, we will now proceed in our purpose, with more attention to method.

It is a complaint urged now more frequently than at a period more remote, that the characters of inflammation are not sufficiently determinate. By this remark is intended to be conveyed an idea of the difficulty opposed to the establishment of certain uniform essential signs which may serve the purposes of correct definition. I think the objection groundless; and that upon this occasion as on many other subjects of our science; an affectation of refinement, has superseded a regard to facts. That plain and natural expressions have been removed to make way for, or obscured, by being blended with, arbitrary and capricious conceptions; and the laws of disease, not deduced from nature, but made for her; or rather, to suit the prejudices of writers. No one, I presume, who is informed with a moderate degree of accuracy, on the general laws of the animal economy, can be for a moment at a loss to detect the presence of inflammation, when that condition of parts does exist, provided those parts were accessible to examination. He could be involved in no difficulty as to the existence of inflammation, if its laws were then in operation, or even in ascertaining their previous operation, where its consequences still remained. I have before ventured to compliment the old writers upon inflammation, on their fidelity and accuracy of observation. And I think we shall find by a recurrence to the records of that period, dark and unscientific as it was, that the tribute was not unmerited. In these records we shall find the phenomena of inflammation laid down as they then were,

as they now are, and as they ever will be. And I dare to hazard the assertion, that we cannot improve the description, by adding to, or taking from the number and character of the signs they have presented us.

Together with their accuracy of observation, we find in those writers a remarkable concordance of opinion as to the symptoms of inflammation. No diversity of sentiment, regarding the mode of its production, has in the smallest degree affected its diagnostics or definition. They all agree in assigning as the distinguishing features of such a deviation from health, four uniform and essential marks or expressions, viz: increased heat, redness, tumor and pain. These make up that result of observation, which I have said for fidelity and accuracy, will not suffer by a comparison with the opinions or discoveries of the present enlightened age upon the same subject. I will go one step farther, (and rest the proof of the assertion upon what will appear in the course of these remarks) in advancing a declaration that some Pathologists of our day, of more than modest pretensions, have fallen into gross error, when those early adventurers in science have adhered strictly to the evidence of truth and nature.

In the writings of Hippocrates, little is said respecting inflammation; nothing distinctly. In his work however, "*De Capitis Vulneribus*," he says, that the parts in the neighbourhood of the wound become inflamed and tumid, on account of the influx of blood into them. He of course means the influx of more than ordinary or natural quantity of blood. He says nothing of the mode by which the parts were fitted to receive a more than ordinary quantity of blood, or how such quantity effected its passage there. He enters into no discussion of the subject. Yet as far as his remark extends, it is undoubtedly the result of correct observation. A result similar to that which we deduce from our attention to the subject at the present time; and simple as the notice is, we shall find nothing better calculated to open the right road to farther enquiry, in the more labour-ed accounts of his successors, for many years. His Disciples, not satisfied with his plain doctrine upon the subject, (for it certainly was reasoning about inflamma-

tion, though but partially, to say that it was occasioned by too great a flow of blood into a part) attempted to extend and improve it. He is however under no obligation to them for the attempt. They would have done him a greater favour by calling it when thus altered, their own doctrine. Rejecting the influx of common blood as insufficient, they held the inflammation to consist in the influx of a fluid (it might be blood, or any other fluid of the body) possessing acrimony and viscosity, with a capacity for attracting similar fluids.

It will not be stepping far out of our path to see how those doctrines, absurd and awkward in their present dress, would look if translated into language more consonant to our taste and comprehension. From motives of curiosity we will examine briefly what amendments could be thus made. They saw effects which they attributed to acrimony, viscosity, and attraction. They witnessed an increased quantity of fluid in a part, saw it detained and gradually augmenting. Suppose then we say their *acrimony* was a cause preternatural stimulating the vessels of a part and exhausting their tone, permitting an unusual flux of blood into the part affected by diminishing the capacity of its vessels for resistance to the current from behind. That their *viscosity* was an impeded current of fluid through the part, from defect of power in the vessels to send it on. And that their *attraction of more fluid* was a continued augmentation of quantity in the part from increasing disability in those vessels, to oppose its entrance into them, or part with after they had received it. But it is not our intention to anticipate discussions which belong more properly to another place. We turned aside to notice that we have thus early an argument in favor of our position that the phenomena of inflammation, are not vague and indeterminate. That we held them established on the ground of experience, before reason as the instrument of demonstration could serve the purposes of our knowledge as to the cause and mode of their existence.

Erasistratus, another writer of some celebrity and great antiquity, for he lived some hundred years before the christian era, has given us an opinion on the subject of inflammation. He appears to consider inflammation, not

as some have asserted for him, as occasioning certain motions in the blood, by which it was impelled into places or parts it did not naturally occupy, for this is involving him in absurdity, by making him speak of inflammation as present, before it could be known to exist, but as the consequence of certain motions excited by some cause in the blood, by which it was forced into the small vessels, at that time thought to be air tubes, and into the spaces supposed to exist every where between separate parts.

Here then we have the first direct notice of the Boerhavian doctrine of *Error Loci*. A doctrine less misconceived as to fact, than mistaken as to principles. For that there is too much blood in an inflamed part, every body will now admit. Even those writers, on whom modern opinion has concurred, to confer the proud prerogative of universal decision, can in no other way explain, one of the invariable characters of inflammation; viz. Redness.

Though we take up the Boerhavian doctrine rather out of order as to time, yet having fallen in our way incidentally, we will notice it here. This doctrine holds a pre-eminence as the doctrine of *obstruction*. It is true this distinction is somewhat partial. For obstruction in some form or other, was the fundamental principle of inflammation, with nearly all Boerhave's predecessors. But it claims this regard from having been the first to examine closely, the capacities of the part receiving, and the condition of the fluid received. Save this it has little merit. And even for this its title to credit is equivocal. Before his time, Harvey's discovery had put to flight the doctrine of *fluxions*. Congestion was not so easily routed. For between it and the subsequent favourite obstruction, there is much intimacy. In the latter, the blood, &c. is *forced* into places from whence it cannot escape. In the former it wanders there casually, and is locked up, or not permitted to get out. But congestion being disgraced by having kept company with fluxions, its name was seldom mentioned.

It was Boerhave's opinion, that inflammation was caused by an impeded circulation in the small vessels. This obstruction was owing to a lentor, from uncommon

density of the blood, which arresting its free passage, it remained stationary in those vessels, until by the resistance thus opposed to the current from behind, the heart was excited to more powerful efforts, and if it was not forced through the vessels by the repercussion thus produced, part of it was impacted or wedged fast, and part of it driven into the smaller series of vessels, in consequence of their mechanical dilatation. This last effect was called "*Error Loci.*" As the vessels which were supposed to convey only serous fluid before, now contained red globules. The irritation of the heart caused by the impediment to circulation, was supposed to occasion a more powerful impulse, a dashing or friction of the blood against the walls of the obstructed vessels, in the parts still pervious. Hence followed heat and pain. The tumour and redness were the consequence of unusual quantity of blood in the obstructed and enlarged vessels. If the repeated and forcible propulsion of the current a *Tergo*, did not effect a passage by driving out the mass of blood, which plugged up the vessels, thus accomplishing what was called a resolution, then changes took place in the part said to be consequential to an acrimony, either originally possessed by the blood, or acquired by its stagnation. On this acrimony depended all the mischievous terminations of inflammation.

Galen and his followers entered more deeply into this subject. They are the first who have given us a distinct and clear enumeration of the principle features of the disease, in connection with those accompanying characters, which though secondary and consecutive, come on so early, and are so strongly marked, as to claim a consideration in the account of genuine inflammation. In laying down their definition, they give us the following train of symptoms: Increased heat, redness, tumor, pain with tension, and a sensation of throbbing in and about the part. That they have failed in applying a philosophy, which will satisfactorily evolve the laws by which those phenomena were produced, we must admit; yet the strictly correct notation of those phenomena, is placed beyond the ground of controversy. We shall look in vain into the records of modern pathology, for any thing upon the subject more accurate and intelligible. When

they come to the application of their philosophy, such as it is, we find them holding their principal law upon courtesy. They beg the ground from which they set out. Inflammation with them consists in too great a flow of *uncommonly warm blood* into a part, which gives it the first increase of heat, and the redness. The vessels becoming too full, the finer parts of the fluid exude into the empty spaces about them, giving the increase of bulk, and producing tension, pain and throbbing, by putting the parts on the stretch. To account for the progressively increasing temperature of the part, they called in the aid of putrefaction of its contained fluids. They do not tell us how the blood became *unusually warm* in the first instance, yet we can forgive them their neglect on this head, for if our opinions on the subject of animal temperature, are correct, they could know nothing about it. The state of their chemistry, is an ample apology both for the omission and their ignorance.

Old Celsus used to say, "*Ases nostra conjecturalis est,*" and we are almost persuaded to believe him, when we observe with what curious consistency opinions are linked together: each preserving some trait by which their relationship to their predecessor may be known. The opinion of Galen about the effusion of fine fluids in inflammation, was in some measure new in his day, and though it is old now, it has not been forgotten. A celebrated philosopher of the present age, finds it convenient to call in the aid of this same effusion, in the elucidation of the same subject. It is true he has made an addition to the doctrine of effusion, which Galen never dreamed of, viz. The manufacture of blood vessels in it. In order to spoil as much farther as possible the likeness of Galen, he determined also to cut something off; and instead of removing the putrefaction as a cause of heat, he took away the heat itself. A feature in our opinion as well entitled to a place in the picture, as any which has been suffered to remain.

The Galenists advanced a step farther in this road, than their predecessors, and effected a division of inflammation into two species, to which our terms acute and chronic, bear a very close analogy. These were in their language, the first a consequence of sudden and rapid

influx of blood into a part. The second they called simple obstruction. The complete doctrine of *fluxions* and *congestion*. A subdivision was then established into varieties, receiving specific names from the supposed causes affecting their diversity of sensible signs. Supposing the two first to consist in a change effected by the pure blood alone, the latter they considered the consequence of foreign admixture with the blood, such as bile, phlegm, &c. And upon these principles they attempted the illustration of many modifications of inflammation. To a differently vitiated state of the blood were ascribed Œdema, Erisipelas, Schirrus, &c. It will not be necessary to follow them in those minute and capricious details, which establish any thing rather than fact or probability.

The principal proselytes to this doctrine of inflammation, were Etius, Paulus Ægineta, Oribasius, Fernelius and Sennertus.

I will in this place, recur for a moment, to a subject noticed in the first stage of enquiry into the early doctrines of inflammation; to wit, that I believed we should find the old writers in possession of some important and just grounds of conclusion on this head, as to fact, though they had arrived at them by tortuous and obscure roads, in regard to their philosophy. Or the principles by which they attempted to illustrate their mode of production. As far as we have advanced, one particular trait or feature appears to have served as a land-mark to every traveller who has imprinted his footsteps upon this road of hoped for discovery. The evident increase of contained fluid; the sensible signs of unusual flux of blood into an inflamed part has arrested the attention of every adventurer, and found a distinguished place in every chart of observation. It has been already remarked that the moderns assented to their accuracy in this particular. The combatants on the theatre of inflammation now leave uncontested this solitary point, contented with evincing their dexterity in unfolding its law of universal production. That the old authors were also right in another particular, viz. the impeded current through the part, I would infer from the very admission here adduced. For I think we know enough of

the natural action of vessels to be satisfied that if in any part those actions are so much overcome as to permit more blood to flow into the vessels than they can manage, in other words transmit, in proportion to such loss of power in the general will be the quantity of their contents. But more of this in future.

The doctrines of inflammation were next taken up by the chemical school. And we are not surprised to find its principles as confused and unsatisfactory, as the sources from whence they were drawn, were obscure and unintelligible. We see them in the first stage of enquiry occupying nearly the same ground, traced out by their immediate predecessors, the Galenists. The "*febrile effervescent state of the blood*," of Dele Boe, Willis, and the other chemists, is the unusually warm and putrescent state of the blood of Galen and his followers. In their view of local disease simply, (to which the old doctrines are very much confined) both those theories presuppose an indefinite state of parts. With Galen there is a flow of unusually warm blood into a part producing obstruction slowly and a disposition to putrefaction; thus causing local heat and other phenomena. Inflammation and its phenomena here follow as a consequence of certain changes in the blood which are left unaccounted for, viz. its unusual heat and putrescent tendency. The chemists on the other hand assert an *orgasm*, or disposition in the part for obstruction, which as soon as acted upon by "the effervescent state of the blood," begins to evolve immediately the signs of inflammation. They ventured a little farther and attempted to account for what they considered the chief feature of inflammation, viz. heat. They asserted that from particular causes the more volatile and subtile parts of the acid and alkaline principles of the blood were thrown off, and lost, that in consequence of the nice equilibrium which those subtile parts preserved being destroyed, those principles became more acrid, and exerted a mutual action upon each other, by which the *phlogiston* resident in the oily part of the blood was more freely evolved. Thus producing its febrile effervescent condition. And this effervescent heat evolving state, they said, would come more fully into action in parts through which the motion of the blood was retarded, ac-

counting by this inference for increasing local temperature. We cannot attempt the defence, and think it unnecessary to enter upon a refutation of such doctrines.—They were deductions from a science at that time grounded on false principles.

But of all the old writers upon inflammation, none of them appear to have attracted more attention than did the celebrated Etmuller, in his day. He too, was a distinguished chemist: yet his theory of inflammation is far from being simply an application of the then principles of chemistry. He took a wider range, and fell in with some of the principal views of the subject which hold a place in many modern doctrines of the pathology of inflammation. He published at different times, two opinions on inflammation, differing considerably in their leading characters. In the first, he attempts to explain upon chemical principles, the existence of natural heat in the blood, which he says is owing to the reciprocal and duly proportionate action of a volatile spirituous acid, and an alkali, both naturally resident in the blood, upon each other. Beyond this point his chemistry is carried but little way. The preternatural heat of inflamed parts, he says is owing to the predominance of an acid or acrid property in the blood, occurring from an altered proportion between the component parts above alluded to, by which the *influent spirit* of a part is unusually excited. And from that cause an uncommon determination of blood to such part takes place. At the same the *innate spirit* of the vessels and fibres of the part is roused: and from this increased action and reaction, *increased heat* is generated. Moreover the nerves and muscular fibres being put upon the stretch, by the augmented contents of the part, irritation and pain occur, spasms and contraction take place, and the blood impeded in its progress, or entirely cut off from its passage into the veins, tumor, tension and redness unavoidably follow.

In the same manner he accounts for inflammation from an external cause. By way of illustrating that effect from the latter cause, he selects from Van Helmont the example of the thorn piercing a sensible part of the body, by which pain, heat, redness and swelling are produced. In both those kinds of inflammation, the remote (proxi-

in ite with him) cause, is an acid or acrid stimulant property, exciting the *influent spirit* (or nervous power) of a part, which again affecting the *innate spirit* (or irritability) of the vessels, and increasing their actions, there follows from those primary and secondary effects of stimulus, obstruction, heat and all the phenomena of inflammation.

Here then we have brought into co-operation the hostile agents of Haller and Whytt; the *vis insita*, and *spiritus nervosus*. Here too, we have a broad view of common intelligence upon the pathology of inflammation, in the present day. For in some shape or other, the ideas of irritants, sensibility, irritability, and increased action, are floating through the understanding of most of those who every day see and treat that condition of parts. The relation of cause and effect is here some morbid agent, producing a change in the chemical affinities of the blood of a part, by which it acquires an unusual stimulant property. From whence follows increased action, augmented heat and obstruction.

Ktmuller's subsequent opinions on this subject are more extended, and parts of them ingenious. In his last publication he makes the proximate cause of inflammation to consist in a preternatural collection of blood in a part, confined there on account of impeded passage from the arteries into the veins, more being received by the former than flows on into the latter. And as the blood is a red, warm and spirituous matter, in consequence of its detention, it will render all the heat of the detained quantity sensible, and thus also produce the redness.—The tumor is accounted for in the usual way, from fullness of the vessels, and the pain from distention.

In this part of the opinion now under consideration, we have with but one alteration, the old and favorite hypothesis of obstruction. He does not here assert or admit a preternaturally heated condition of the blood in inflamed parts, but accounts for the sensible heat of such parts from the blood in them giving out a greater quantity of its natural heat, from its confinement, than it parts with in its ordinary current through them in health.—Judging from obvious phenomena alone, he considers the primary symptoms, together with their consequences, as

simply the result of interrupted communication between the arteries and veins. His explanation of the presence of preterordinary heat constitutes the aberration alluded to, from the old doctrine of obstruction; and looks very much like a regard to the nice distinctions now so much agitated respecting evolution of heat and temperature.

In the 2d division of his last opinion he goes on to reason about the termination of inflammation in suppuration and gangrene. The former he makes a consequence of corruption of part of the fluids from stagnation, or their being thrown out of the circulation. The latter, viz. gangrene, takes place when the blood of an inflamed part, by being entirely cut off from the general mass and thus deprived of its vital *influent spirit*, robs the part of its *innate spirit* also, which depends upon the former, and in this way the death of the part ensues.

We have something in this reasoning, differing but little in terms, and still less in fact, from those modern doctrines which assert the most pointed and pertinacious claims to correct science on the subject. For we have here the vitality of the blood, of one school, on which the life and actions of a part, as of the whole system depends. Or we may call it the oxygenous state of the blood of another sect of philosophers, productive of the same effect. With one and the other in proportion to the existence of their appropriate principle, will be the life and powers of a part. And when that condition of the blood no longer exists, its life and power giving properties are totally extinct.

This part of his latest opinion contains also his first attempt, and indeed the first attempt among the old writers, to account distinctly for the circumstances leading to the ultimate terminations of inflammation.

Sydenham, who was celebrated in his time for fidelity and accuracy of remark, and still retains some of that celebrity, has not passed this subject without notice.—But his opinions on inflammation are among the few deductions we are now compelled to make from his numerous claims to respect on the score of fair and just observation. Indeed his sentiments upon this subject bear no evidence of rational inference from the known characters of inflammation, but rather appear the result of vague

and thoughtless conjecture. He refers for the primary cause of inflammation, to an undefined something producing a preternaturally heated condition of the general mass of blood, in which state he supposes that certain portions of it becoming (still from unknown causes) more heated than the rest, are conveyed accidentally to those parts of the body in which inflammation subsequently appears. Such with him is the origin of Phrenetis, Peripneumonia, Erisepelas, &c. He says nothing about the manner in which such effects are produced. Neither does he notice any previously altered condition of part; or in any other way attempt to remove the obvious difficulty, why increased temperature should be innocuous every where in the body, save at those points where inflammation occurs as its consequence.

But the leading feature of this doctrine is too absurd to admit a farther attention to it. For I think we know that it is totally impossible for one portion of a mass of blood which is *equally* subjected to the laws of circulation, either to acquire, or if it could, to *retain*, a more considerable elevation of temperature than any other.

Next in order of time we are presented with a view of the theory or pathology of inflammation, instituted by what has been called the Mechanical Sect of Physical Philosophers. I think the distinction not just or necessary; and so far as applied to the doctrines of inflammation, if we except the chemical philosophy on that head, we shall find but faint shades of difference between the opinions of this sect and those of their predecessors.

Pitcairn, Belleni, Hoffman and Boerhave, were the most distinguished advocates of the mechanic and hydraulic doctrines. The latter appears to have bestowed the greatest care and attention in explaining and applying those principles, and occupied in his day a pre-eminence in this particular, which he still holds. It is called the Boerhavian doctrine.

I have already discharged towards this doctrine, the obligations of courtesy, in bestowing upon it a passing notice. But having fallen in with it again, I shall be pardoned for offering it a little farther attention.

The Boerhavian doctrine (for which we refer to the early part of this essay) demands the pre-establishment

of two data, on neither of which it can now be permitted its rest. It presupposes, First, That the arteries are mathematical cones, of a regular though greatly extended figure. Secondly, That the action of the heart is the only power by which the blood is propelled through those tubes. We know that the arteries are not cones: That the compound area of the branches does not correspond to the mathematical capacity of the trunk. We have sufficient evidence also that the blood does not obey in its motion, the laws of mathematical projection. The recurrent branches of vascular structure, would fully refute this position. The vessels possess powers of their own, subject to similar laws of structure with the heart itself. They harmonize it is true with the actions of the heart in health. The systole of the heart is the result of a *universal* law of vascular action. But under particular circumstances of derangement, the natural relation is in part lost. Parts of the vascular system are then obedient to the operation of specific laws, not as to *time*, but *force* of action.

The Mechanicians do not attempt to explain by what *novel law* heat occurs to the obstructed mass from *attrition*: they tell us of friction of the circulating fluid, from increased vis a tergo, and additional impulse against the quiescent portion of blood. But heat never was acquired by fluids from simple motion, however impetuous the current, or how great soever the resistance. But were such a consequence of the cause assigned possible, it would not prove enough for the present purpose: for the condition of the general system does not always bear a sympathetic relation to the diseased action of a part in inflammation. Yet increased heat of the part, (if measured with a regard to the inflamed, and natural state of such part,) does exist when this correspondence of the system is wanting.*

The mechanical doctrine was never completely dominant. While numbers subscribed to its orthodoxy, a

* It is not surprising that Mr. Bell, in the introduction to his *Treatise on Ulcers*. (page 28) should have told us, "that the heat of an inflamed part, results from the friction or attrition of its blood." Great men it would seem may say any thing.

few sceptic pens were brandished against it with determined hostility. *Gorter*, *Stahl*, and *Sauvage*, were among the first, and were also the most distinguished of those who unfurled the banner of opposition. Their attempts to occupy that ground in public sentiment, from which they were labouring to eradicate their predecessors, were not without ingenuity, particularly those of *De Gorter* and *Sauvage*, and though they are disowned at the present day as authority, I think we shall perceive they are not despised. We shall then have another proof how easily obligations are forgotten, or denied.

I am aware that in giving those writers a place among the anti-mechanicians, I invade the ground of general opinion. They have been placed by their contemporaries and successors, on the same list with them. Yet a careful examination must satisfy the enquirer, that they have proceeded a great way in advance of the hydraulic doctrine of their day, and have attempted though without complete success, to plant the standard of opinion, among the fixed and natural laws of the animal economy.

De Gorter was the first who aimed a decisive blow at the doctrine of primary obstruction, in inflammation. He appears to have taken a comprehensive view of extended vascular action; the actions of small as well as larger vessels. He is the first who noted distinctly the sensible signs of increased vascular action in a part, in the forming stage of inflammation, and asserted the inadequacy of partial obstruction, for the production of those phenomena. He ingeniously founds his objection upon the anastomosing structure of the vascular system; advancing the opinion, that the obstruction of a few branches of an artery, could not produce a perceptibly increased action, in the open branches of the same vessel, nor by consequence, any augmented velocity in the motion of their blood. Nor, he says, can the heat any more than the pulsation, and other evidences of increased action be accounted for, from obstruction simply: And adopting the converse of the proposition, on this head, rationally concludes, that the heat will be in the inverse ratio to obstruction, supposing it complete, in the vessels in which it existed. When I call this a rational conclusion, I

must be understood as subscribing to the doctrine no farther than I think it fair to infer, he meant, though the opinion has not been guardedly expressed. For when he says that diminished temperature of the blood succeeds to its obstruction, I understand him to suppose, that when any considerable impair of connection between the blood of a part and the whole through the medium of circulation, takes place, the temperature of the former falls off, in consequence of its losing equal access with the rest to the great source of heat. But to return to the doctrine as given by himself.

Gorter assumes as a first principle, a *vital motion* in the heart and arteries, as the cause of natural heat. From this ground he advances to the assertion, that all causes capable of exciting to a certain degree increased general or local vital motion, produces a correspondent inflammatory disposition. That general inflammatory diathesis, is the consequence of universally increased vital motion. Local inflammation, when such excitement is confined to the vessels of a part. He opposes the inference, that heat, pulsation, and other phenomena of inflammation arise from obstruction. And refutes the deductions drawn from analogy between inflammatory obstruction, and that produced by ligature. One argument on which the advocates of obstruction reposed with much confidence. He proposes the objection (as before noticed) on the ground of frequent ramification and anastomosis, of the extreme vessels. A few of which being obstructed, could not occasion so much difficulty in the circulation, as to render a sensible increase of action necessary.

A considerable degree of apparent connection exists between the increased vital motion of De Gorter, and Stahl's, increased tonic power of the vessels. But Gorter does not appear to have entertained as much confidence in the credulity of mankind, as Stahl and some of his followers. He no where introduces that intelligent animal principle, or second soul, which those gentlemen offer homage to, for kindly undertaking to regulate the laws of disease, to the best advantage. He might have wanted confidence in the existence of such a good genius, or if he believed in its existence, reasoning from obser-

vation he probably thought its duties so badly performed, as to leave us under no obligation. Or what presents the fairest claim to credit, De Gorter perhaps never imagined that inflammatory action was any part of the healthy economy.

The summary of this opinion then is, that whatever causes excite unusual arterial motion, (alias increased action) may produce inflammation, general or local, in proportion to the extent of parts affected. By general inflammation, meaning fever, either with or without local inflammation as a consequence. By local inflammation a condition of parts in which their capacity for action is brought more fully into operation. A condition which may be confined to the part, may be partially extended, or may produce sensible increase of action over the whole system. This vital motion, or action, produces all the sensible states and changes of inflammation, by its increase, falling off, and exhaustion; or the cause being removed, or ceasing to act; the parts, &c. return to the natural state, by the gradual decline of this increased vital motion, or action, to the healthy or near the healthy standard.

De Gorter has the merit of being the first, (so far as I can discover,) to lay the ground work of inflammation in *vascular action*. His doctrine of a century past, is one of whose errors we have not entirely washed our hands: And whose truths we have been slow to improve. Had he been better acquainted with the natural and relative *capacities* of vessels, and the principles of animal temperature, he would have left us on this subject nothing to retrench, and perhaps but little to add.

The hydraulic doctrines met their most determined and dextrous antagonist in Sauvages. Their most formidable one too, for he wielded against them their own weapons. He contends from the known laws of hydraulics, that the velocity of moving fluids must decrease in proportion, to the obstacles opposed to them. He holds it an indisputable theorem, that if one-third of the branches of any tube be obstructed, it requires a quadruple impellent force, to give the same quantity of fluid equal velocity, as it possessed previous to the obstruction. That

motion dependant on impelling force, will observe a similar ratio progressively to resistance.

Neither he says will it favour the hydraulic doctrine, to admit that the arteries are *elastic* tubes. For they could not recover themselves when distended, so long as the distending force continued to act; and when it was taken away, they would recover only in proportion to the dilation they had undergone. They could thus communicate only the force they had acquired by distention, which could effect nothing more than the natural or ordinary velocity of the bloods motion. Yet Sauvages assents to the existence of increased velocity of the bloods movement in inflammation, and having proved it irreconcilable with all known mechanical and physical laws, escapes from the difficulty in which he is thus self involved, by appealing to the agency of some president divinity, by whose interference and aid, actions adequate to the effect are excited. An indulgence of the imagination which philosophers have always found convenient.

Thus far we have been engaged in noticing early opinions, the sentiments of what are called old writers, upon the subject of inflammation. We have adopted the distinction long since instituted, and still existing; their clasification as Humoralists, Chymists and Mechanicians. I have added to that distinction, the opponents of the latter doctrine, and placed on the list of the most distinguished of them, under the title of anti-mechanicans. How far such an arrangement is just, is not of consequence, as we are in search of opinions, not titles.

The limits proposed to this essay, would not permit a diffuse examination of individual sentiment, in reviewing those opinions. A few only, from among the writers of each of the grand divisions, and those the best known, or most respectable at the time they lived, have been held up to notice; as from those may be procured the clearest perception of the different doctrines. A wider range embracing the speculations of advocates and commentators, would add nothing to those doctrines, and must embarrass our comprehension. We have moreover arrived at that stage of enquiry, at which we think a pause may most properly be made. For in the doctrines of De Gor-

ter we have an attempt to bottom the pathology of inflammation on vascular action and capacity. The ground on which it stands at the present day. We will now pass the artificial barrier, and in falling in company with the moderns, carry with us a hope that fanciful terms, and arbitrary distinctions are to be exchanged for an introduction to rational principles, and correct science.

It will not be necessary in the progress of an enquiry, holding in view a distinct and almost insulated object, to notice the multiplied systems of physic, to which the present age has given birth. In many of them, the subject under consideration, has either been entirely neglected; or but incidentally attended to, as a minor part of those general researches into the philosophy of disease, deduced from the prevalent opinions respecting the healthy economy. The truth appears to be that in our science, as in most others, the proud spirit of philosophy has disdained an appeal to the patient and accurate examination of particular facts. The characteristic expressions of certain forms and conditions of disease, have not been called upon to aid in a general estimate, or the establishment of general principles. But have been capriciously subjected to an unnatural connection with preconceived notions adopted without enquiry, and applied without discrimination.

It is in this way that common marks of diseased condition have been entirely overlooked or inaccurately accounted for. Affecting comprehensive views, writers have begun precisely where they should have ended.—Omitting the faithful attention to facts which common sense would dictate, and observation might furnish, those self created judges in the court of nature have frequently passed sentence on her works, without examining her evidences.

There is no department of physic which has held so little importance in the estimation of professional writers, as the pathology of inflammation. It appears to have been thought an aberration from professional dignity, to enquire minutely into the causes and nature of a diseased condition so frequent in its occurrence, as no longer to excite professional curiosity, and so intelligible in its

phenomena, as to have fallen for the most part under the curative direction of nurses and old women. When this condition occurred to any internal part, or important organ, it escaped the opprobrium of vulgarity; and being thus elevated above its ordinary level, received from medical men, the notice which had been denied it under common circumstances. But it was then decorated with specific titles. And instead of inflammation of the brain, lungs and pleura, &c. it was ennobled by the appellations of phrenitis, pneumonia and pleuritis. This inattention to common inflammation has been so general, that it is difficult to meet with a writer, who has paid it more than partial regard. The projectors of *systems* of physic especially, to whom we should conclude it proper to refer for information on this subject, have permitted it to remain without the scope of their researches. And when we meet with aid in the prosecution of such an enquiry, it is from writers who have been casually led into its examination, by its connection with a different and favourite object of pursuit. But as it will probably be thought incumbent on me to shew, the relation it has held to the medical philosophy of the age, I have consulted the pages of a few distinguished writers for this purpose.

Since the decline of the school of Montpellier, Edinburgh has been pre-eminent as authority, in the science of physic. Regarded as the great theatre for the cultivation of that science, the genius and talent of Europe, so far as engaged in its pursuit, has been confided to her direction. And the knowledge acquired under her auspices, has wanted no other testimonies of its respectability, than the official signet of her approbation. I shall select from the numerous class of writers, who have attempted to give permanency to doctrines, compiled from materials afforded them by this venerable school, Cullen, Brown and Darwin. The chief favourites of the last half century. Their pathology of inflammation challenges no extraordinary respect, and will not detain us long.

Dr. Cullen says, "A spasm of the extreme arteries, supporting an increased action in the course of them,

may be considered as the proximate cause of inflammation. At least in all cases not arising from direct stimuli applied; and even in this case the stimuli may be supposed to produce a spasm in the extreme vessels.*

The Doctor, in his reasoning upon those positions, supposes, "That some causes of inequality in the distribution of the blood may throw an unusual quantity of it upon particular vessels, to which it must necessarily prove a stimulus." The blood thus unequally distributed, causes obstruction. But to effect a removal of the congestion, "A spasm supporting an increased action in the course of the vessels, is necessary. The increased action effected by means of the spasm, is intended to overcome the obstruction. And the spasm itself, results from "the stimulus of the blood," and the "*Vis medicatrix natura*."

Congestion then and *spasm*, constitute with Dr. Cullen the essence of inflammation. He makes congestion the cause, not a consequence of inflammation, and the spasm a part of the inflammatory process, but intended for its ultimate relief, by exciting increased action. The first is altogether unphilosophical. The latter supposes, either that the accumulated quantity of blood is to be driven through the vessels by the increased impellent force from behind, *while their calibre is lessened by constriction*, both the work of the spasm; or else that this spasmodic constriction expels the blood by imparting to it a retrograde course. In the first instance the spasm increases the resistance to circulation, while it augments the power for effecting it. In the second, it excites an action (increased *vis attergo*) fitted to defeat its object. These are irreconcilable contradictions: and with the exception of the spasm, this is the doctrine of Boerhave and Hoffman; the doctrine refuted by De Gorter and Stahl. The congestion must have had a remote cause. The spasm must obstruct circulation. And we are unacquainted with any such thing as a reversed order of contraction in the vessels. A condition indispensable to a positively retrograde flow of blood.

Dr. Brown's pathology of inflammation, like his doctrine of general disease, is at first view imposing, because apparently simple. Those doctrines have been stamped with the approbation, by indulging the indolence of mankind. The favouritism thus obtained, has perhaps been enlarged and confirmed by the rancour which his growing fame, dissolute life, and severity towards the opinions of others elicited from his competitors.

Dr. Brown divided diseases into two genera. He has given inflammation a similar classification. His general principles possessed but a narrow footing, and the harmony of parts must be strictly preserved, or the whole fabric must tumble. Inflammation with him is sthenic or asthenic. The vessels in the first state act with uncommon energy, and send on their blood rapidly; in the second, the vessels are preternaturally feeble, and the blood moves tardily.

It is only necessary to observe of this doctrine, that its premises are irrational. Inflammation is but *one effect*, and here are *two causes* diametrically opposite. If increased action constitutes inflammation, diminished action is its negative, or *the absence of inflammation*. If diminished action simply or of itself could cause inflammation, (which is inverting the order of positive and negative) then increased action ought to cure it; and the higher it rose, the farther distant it should become from the diseased condition. The laws of the human body are too simple and uniform for us to think of inventing a scale by which these unnatural gradations (or degrees) of action are to be happily coaptated. I shall notice some of the absurdities (as I conceive) of those doctrines in another place.

I ought perhaps, to ask pardon for having promised to examine Dr. Darwin's theory of inflammation. It is so inextricably implicated in the mazes of metaphysical subtlety, that I really cannot apprehend it.

In *Zoonomia*, page 996, Dr. Darwin remarks, "that when any part is excited into such *violent motion* that a quantity of painful or pleasurable *sensation* is produced, it frequently happens, *but not always*, that *new motions* of the affected organ are generated, in consequence of the

pain or pleasure, which (new motions) we call inflammation. These new motions are of a *peculiar* kind, tending to distend the old, and produce new fibres, and thence to elongate the straight muscles which serve loco-motion, and to form *new vessels* at the extremities, or sides of the vascular muscles."

The reader has now the doctrine before him, and must make the best of it he can. I would only observe, that it is difficult to comprehend what is meant by "*a violent motion in a part*:" that sensation when it accompanies inflammation is a consequence, not a cause: that *new* (or irregular) motions, attended by either painful or pleasant sensations, frequently occur without being followed by inflammation: and lastly, that simple motion, new or old, does not constitute inflammation. The Doctor (or his friends) must explain what is meant by a *peculiar* kind of motion, before we can meet him on that ground.

We will now pass to the opinions of the celebrated Mr. Hunter, of London. The *famous John Hunter*, as called by Mr. Cooper. Mr. Hunter has wrested from his competitors nearly all honor on this head. He has given to common opinion a bias on the subject which hitherto has promised to be permanent. For to no other theory of inflammation has assent been so general, or opposition so feeble. His doctrines are copious and diffuse; and his efforts to give them a specious and imposing attitude, were arduous and persevering. They were aided too, by industrious research, by capacities of more than ordinary enlargement, and not a little by an ardent and excursive imagination. We shall engage in an extensive discussion of Mr. Hunter's principles; possibly with more freedom than ability. But we believe them erroneous. We think them also confused and self-contradictory. For those reasons we affect an undertaking in which to fail can scarcely be disgraceful, and to succeed, even partially, must be useful. Mr. Hunter's general respectability we willingly subscribe to; and if we know what decorum is, it shall not be forgotten in examining his pretensions. We claim every thing which *truth* will warrant, and nothing more.

There is great difficulty in comprehending Mr. Hunter's vague and fanciful phraseology. He has assumed

a license in this particular, unparalleled in medical writing. I make this prefatory remark, not so much as an apology for any misapprehension of Mr. Hunter's sentiments, into which I may fall, but to notice (as must be obvious to every reader) the extreme difficulty of reducing his loose expressions and detached opinions into order or connexion. It is a work truly Herculean (if at all to be accomplished) to fit the scattered members of this theory to each other in such a manner as to present a perfect body, which may be compassed at one view, and which shall possess due harmony and relation of parts. I repeat that this is not an apology for defects, from which, as a student, I expect not to be free, and challenge him who is more confident of his powers, or more attached to Mr. Hunter's opinions, to the trial.

Before proceeding farther, I will appeal to the candor of my readers for an exculpation from the charge of rudeness in asserting that Mr. Hunter's doctrines were confused and self-contradictory. He says,

"I have given the most simple idea I can form, of an injury done to a part, with the natural, immediate and consequent means of restoration. I have also treated of cases, where they become *a little more complicated*, (the means of restoration,) requiring the aid of art as a *substitute* for the *simplicity* of the *first*. The *action* of the *parts* is not *necessary* in *either* of *these*, except that of the *blood* forming its *vessels* and *other solid parts*, and becoming of the nature of the parts in which it is *extravasated*. But I took notice that the violence done was often so great, or that restoration did not take place so readily, as in all cases to exclude irritation, we had therefore an action in such cases taking place in the parts, called inflammation. That this action *assisted* in the restoration by producing an extravasation of coagulating lymph, which became the *second* bond of union. I have also stated what may be called the *natural tendency* to inflammation, to serve as a kind of leading principle. We shall find that inflammation may arise from very different causes, and often without any apparent cause, and that its operations are far *more extensive* than simply the act of producing union in parts divided by

violence, for it more commonly produces union in whole parts, or in natural separations, such as the common cellular membrane, large circumscribed cavities, &c. *because such surfaces are not naturally disposed to unite, but only in consequence of some uncommon action being produced.* And although these adhesions are *unnatural*, yet *that tendency of the parts to admit of this union, becomes a species of cure.* It is in consequence of the parts taking on, *in some degree*, the same mode of action which divided parts do when brought into contact, that in such cases suppuration is precluded. As inflammation often arises from *disease*, its *salutary purposes* are in many instances not so *obvious*, although they may finally take effect. As it likewise takes place in *disease*, or becomes the ultimate in *disease*, when it did not begin it, as in scrofula, &c.; on those accounts too, its *salutary purposes* are sometimes not obvious. However, upon the whole, as inflammation is an action produced for the restoration of the most simple injury in sound parts, which goes beyond the *power of union* by the *first intention*, we must look upon it in such instances as one of the *most simple operations in nature*, whatever it may be when arising from *disease* or in diseased parts. Inflammation is to be considered only as a *disturbed* state of parts, which requires a *new* but salutary mode of action to restore them to that state wherein a *natural* mode of action alone is necessary; from such a view of the subject, therefore, inflammation in itself is not to be considered as a *disease*, but as a *salutary operation*, consequent either to some *violence* or some *disease*." Page 237-8.

I shall feel indebted to any one who will render all *or any part* of the above intelligible, or consistent. I confess my incapacity for the accomplishment of either.

Mr. Hunter's fundamental maxim is "that the act of inflammation is to be considered as an *increased action of the vessels*." It has always been understood by his commentators, that an *absolute* increase of action is the position contended for. This then is the chief point of discussion, the one to which all enquiry must be directed. For when Mr. Hunter strays from it he has no longer a *peculiar claim*. Increased action of the vessels of the

part, is the primary condition, (we reject proximate causes,) of the first state of inflammation.

As I intend to contest Mr. Hunter's first principle, I will take up the subject in this place (to avoid confusion) noting his auxiliary positions, and his terminations of inflammation, as I advance.

"The act of inflammation (says Mr. Hunter) would appear to be an increased action of the vessels, taking place in the smaller vessels of a part. The larger vessels may be considered as only the conveyors of the materials for the smaller to act upon and dispose of according to the different intentions; however inflammation in a part is not only an action in the smaller vessels in the part itself, but in the larger vessels leading to it."

"Parts inflamed, when compared with similar parts not inflamed, shew a considerable difference in the size of the vessels. And probably from this cause bring an increased number to view. This incipient enlargement of the vessels upon the first excitement of inflammation, is satisfactorily seen in the following manner. I froze the ear of a rabbit and thawed it again. This excited a considerable inflammation and *increased* heat, and a considerable thickening of the part. This rabbit was killed when the ear was in the height of inflammation, and the head being injected, the two ears were removed and dried. The uninflamed ear dried clear and transparent, but the inflamed one dried thicker and more opaque, and *its arteries were considerably larger.*"

"From these circumstances it must appear that a much larger quantity of blood passes through parts when inflamed than when in a natural state, which is according to the common rules of the animal economy. For when a part has more to do than simply to support itself the blood is there collected in larger quantity."

"As the vessels become larger, and the parts become of the colour of the blood, it is to be supposed there is more blood in the part. And as the true inflammatory colour is scarlet, or the colour of arterial blood, one would from hence conclude that the arteries principally were dilated, or if the views were equally distended, that the blood undergoes no change in its passage from

the arteries into the veins, which I think is most probably the case; and may arise from the quickness of its passage through those vessels."

I must wield against Mr. Hunter's premises the facts he has adduced to support them. He says there is an "increased action of a part in inflammation." Does Mr. Hunter mean an increased *force* or *frequency* of action? He has not told us expressly; yet we must suppose he means the latter. For he says, "There are strong proofs that it is not a *contractile action* of the coats, for in such a sensible state of vessels (as in inflammation) if they contracted by their muscular power, the pain would be in the systole, for we find in all muscles which are in a state of great sensibility, that they cannot act without giving great pain: I should say therefore that in inflammation the muscular coats of the arteries do not contract." But he says "that more blood than usual passes through an inflamed part, and that the scarlet colour of such parts is owing to the blood remaining unchanged "from the *quickness* of its passage through the arteries into the veins." Mr. Hunter cannot have recourse here to any other powers than those of the part itself. "For, he says, "The larger vessels may be considered as only the conveyors of the materials for the smaller to act upon and dispose of according to the different intentions." Besides his first principle is, that there is "*an increased action* of the vessels of the part. How is all this? The vessels are to act *without muscular contraction*. They are to send on their blood with more rapidity in that part, than happens in any uninflamed part, and yet they have *no muscular contraction*, and "*depend upon the larger vessels for the supply*, of the material" (or blood) which they transmit. If they have an increased action, on what does it depend or how effected. If they transmit more blood than in the natural state, yet *depend upon the larger vessels for supply*, where do they get this *increased quantity*? The larger vessels, he says, are *only* conveyers of the material, that is do not take part in the inflammatory action; of course send on to the inflamed part only, a common quantity of blood. The vessels of the part then if they have an *increased action*, and it is not an action of in-

creased *force* but frequency, must have lost a harmony with the action of the *heart* and large arteries, and established an independent rule of action. The question again occurs, where do they get the *power* to act, the *material* to be acted on? Here we are in a sad dilemma; muscular contraction (the only mode of *action* with which we are acquainted) we have rejected; we have also thrown off all connexion with the heart and large arteries: let us see what we can make of *another* principle or power. Arteries, it is said have two capacities naturally, which antagonize each other, muscular contraction, and an elastic property. Let us examine the latter.

Mr. Hunter says, "The vessels, both arteries and viens, in the inflamed part are enlarged, and the part becomes visibly more vascular, from which we should suspect that instead of an *increased contraction*, there was rather what would appear an *increased relaxation*, of their muscular powers, being as we might suppose left to the *elasticity* alone. This would be reducing them to a state of paralysis simply, but the power of muscular contraction would seem to *give way* in inflammation, for they (the vessels) certainly *dilate more* in inflammation than the elastic power would allow, and it must also be allowed that the *elastic* power of the artery must be dilated in the same proportion. When we consider the whole of this (inflammation as a necessary operation of nature; we must suppose it something more than a common relaxation: we must suppose it an *action* in the parts to produce an increase of size, to answer particular purposes. And this I should call the *action* of *dilation*, as we see the uterus increase in size in time of uterine gestation, as well as the os tincae in the time of labour, the consequence of the preceding actions, and necessary to those which are to follow."

We have gained as yet no clear view of this obscure business. The elasticity will not give us the *increased action*. For as Mr. Hunter justly observes, before uncommon dilation can take place the elastic resistance must be overcome; and he might have added, that if it could re-act upon the distending force, the re-action and distention would be simply proportionate, the vessel could only

gather up its natural capacity and size, and would not give us *increased action*, or increased velocity of the blood.

The analogy which Mr. Hunter supposes between this action and the uterine condition in pregnancy is false. For the increase of the uterus at that time is a natural growth, and is attended by none of the phenomena, none of the uniform and characteristic signs of *inflammation*. We will admit too, that inflammation is natural, or takes place by the operation of natural laws, and were we even to concede that inflammation was *healthy*, as Mr. Hunter has imagined, neither one or the other could aid his inference, for inflammation and uterine enlargement are sensibly different in their actual state, progress and termination. Mr. Hunter's position indeed seems to rest upon a presumption that a thing happens or takes place, simply because it appears to him to be necessary, or that it would be useful. This, in my opinion, is a very uncertain basis; a species of conjecture not to be resorted to till facts have failed us, or the deductions from them are useless.

We have still *increased action* without *muscular contraction* or *elasticity*, Mr. Hunter says it occurs from neither, and I know of *no other* power by which any vascular action is accomplished. Mr. Hunter, it is true, says there is a third agent, *an action of dilatation*. I would not be rude enough to assert that this is mere fancy, but I very sincerely confess I cannot affix any meaning to the term, and of course cannot conceive how its existence is to be proved or rendered probable.

Mr. Hunter has rejected the natural powers of the vessels, (their muscular contraction and elasticity) as agents in the action of inflammation; But I will endeavour to prove that he could not explain its phenomena on his principles, by retaining them. We will leave the *action of dilatation* out of the question; and for the reason given by an old philosopher, who refused to examine a child with two or three heads. When told in reply that he would probably never have an opportunity of seeing the like again, "It is on that account said he I care nothing about it."

It is admitted on all hands that an inflamed part contains more blood than it does in the natural state. It is asserted by Mr. Hunter and his advocates, that the blood moves through such parts with greater velocity than in the uninfamed condition. On this supposition is bottomed the hypothesis of *increased action* of its vessels.

On what does action depend? I understand it to be the *exertion* of a *capacity* in obedience to an agent or cause fitted to produce such exertion. Is that capacity *natural*? If it is, exertion or *action* cannot be *greater* than the capacity; if it is within the capacity, and the capacity is natural, so long as it (the capacity) continues, nothing *unnatural* can happen. Now *inflammation* is evidently an *unnatural* condition of a part. How does it take place? Certainly not from the operation of a *natural* action, for this, while it excited, (I repeat) could only keep the part more completely in the natural state, and no change of condition would occur. Yet we are told that *increased action* is the essence of inflammation; that the latter cannot exist without the former. Again I ask, what kind of action? An increase of *natural* action, and yet an unnatural consequence resulting from it? A cause and effect *different*, yet the one producing the other? If this increased action is not the same (saving the augmentation) as it was previous to the occurrence of inflammation, I should like to know whence the action (and the capacity it presupposes) were derived. If it is the same action (only increased) then I should be glad to be informed how the increase is supported, the action the same, yet *the condition of the part altered*, and its functions injured or destroyed.

If inflammation be *increased action* (which if it means any thing means increased vigor or energy of action) how does it happen that it generally takes place, not in parts that are highly vascular, and have naturally great action, but in those which have ordinarily *least* action or capacity for action?

Why do we find people in firm health and robust in body, rarely the subjects of inflammation?

Why are venereal, scorbutic, dropsical and scrofulous patients, afflicted with extensive and tedious inflammatory

swellings and ulcers? Why did they not occur until those persons were rendered feeble by bad health or illness?

Why are the weak and emaciated generally, plagued with protracted and extensive sores, from every scratch or bruise?

Why are drunkards not troubled with swellings and inflammations till after a long course of debauchery?

Why do those who have been long confined to bed by disease, suffer inflammation, with all its worst consequences, in the parts on which they lie, simply from the weight of a reduced body, and the resistance of a soft bed?

Why does the exposure of a part to severe cold, subject it to inflammation and death?

Why are very old people so liable to the occurrence of inflammation, and how happens it that their ulcers heal with such difficulty, and frequently not at all?

Why are the extremities and surface more particularly the seat of inflammation in all persons?

Are all those facts to be accounted for by uncommon vigor and energy, i. e. increase of action?

Let us attend for a moment to an inflamed part.

Mr. Hunter says, and every body agrees with him, that the vessels of an inflamed part are *dilated*; their capacity for containing blood increased. How does this fact accord with *increased action* of those vessels? Mr. Hunter says there is no muscular contraction in inflamed vessels; but possibly some of his friends think differently: it is hard to form an idea of vascular action distinct from their contraction. Suppose then the contraction takes place; and if there is an increased action, there must be increased contraction. Whither would this lead us? Contraction (I believe) means to *lessen* or *draw together*, not to *expand* or *dilate*. If I am not in error, if contraction of a vessel means diminution of its calibre, when the former is increased, will not the diminution be still greater? How then the dilatation? Increased force of contraction, we find, will not answer; and of the *dilatation* we are certain. Let us try increased *frequency* of contraction. If (for instance) the vessels of a part contract in respect to the *number* of contractions, as three to two,

in relation to the heart, how will this answer? Is the contraction of the small arteries of the extremities, those for example of the fingers and toes, *synchronous* with the action of the heart and large arteries, naturally? Suppose their contractions increased in the ratio of one third more than those of the heart and large arteries. First then, where do they send their blood when they have thus *broken the uniformity of circulation*? But especially (for this might be extravasated) *where do they get it*? Not from the heart (the only source I know of) surely, for they have shaken off their dependence on it, and have set on foot an action for themselves. Increased *force* of contraction, it is plain, will not give us dilatation; it seems *now*, that increased frequency of contraction will not answer *alone*; for if it *could* happen, it is still *contraction*, not *dilatation*. We are yet embarrassed and must extricate ourselves from the difficulty. How? is the question. Nobody, I am confident, will offer us the "*action of dilatation*."

Suppose, on the other hand, the natural *energy* and vigour of action in the vessels of a part was *lessened*; that some cause had operated to *weaken* their tone of contraction, and capacity of resistance to the impellant power from behind, viz. of the heart and large arteries. Suppose too, this impellant power, remained in the natural state. What would happen under those circumstances? If the capacity of resistance in the vessels of the part, to the force *a tergo*, the column or current of blood driven on by the heart, &c. was uncommonly *weak*, and this force *a tergo* as great as usual, would not those vessels give way, would they not be forced open, be *dilated*? Or, let us apply the proposition in another way. Suppose that without any known cause of injury or weakness to a particular part, the impellant power of the heart and large arteries, instead of remaining as usual, was considerably increased, might not some part which could bear the *ordinary* force of impulsion, now be found *relatively* weak, that force being augmented? If so, would it not yield to this additional force, and its vessels be *dilated*?

We will now see how the doctrine of Mr. Hunter and

his friends stands, with regard to *increased velocity* of the blood's motion in an inflamed part. We have already proved, (I think) that the vessels of a part cannot assume an action greater as to *frequency* than that of the heart and large arteries, and by this simple argument from fact, that they can have *no action* independent of the heart and large vessels. Take a part which is supplied with blood by the branches of one trunk only, and tie this trunk *above* all the branches which go to the part, will the part die, or can the actions go on, whether the part be previously in a natural or *inflamed* state?

But let us admit this augmented velocity of motion in an inflamed part. How does it take place? Mr. Hunter says, "the vessels are dilated, but do not contract, that the elastic power is overstrained and relaxed." Then shall we say that the vessels being enlarged, there is more room for the blood's passage, and it moves more rapidly on this account? But we forget that this is not *increased action* of the vessels of a part, that they are here passive *relaxed* tubes. But let us grant the increased action of the vessels also, and if it is wished, an increase both of *force* and *frequency* of action. Then we should have *increased velocity* of the blood's motion, no doubt; but what shall we do with the *dilatation* of the vessels, and their *augmented contents*? Does the blood *move rapidly* through the vessels, yet *remain* in them? We have arrived at a pretty conclusion, a thing *is* and *is not*, *moves rapidly*, yet is at rest.

Mr. Hunter argues *increased velocity* of the blood's motion, from the colour of the part, and its increased volume. The increased quantity must be disposed of by augmented rapidity of movement. The red colour can happen only from the blood's passing *too quick* to undergo the venous change, ergo increased velocity. But there is an appendage to this doctrine by Mr. Hunter, which we will here bring into view. "The part inflamed (says Mr. Hunter) I have already observed, becomes, to appearance, more vascular, than when in the uninfamed state; and it is probable that it is really so, both from *new vessels* being set up in the inflamed part as well as the *new* and *adventitious* uniting substance becoming

vascular. Besides the vessels of the part are enlarged, so that the red blood passes farther than common, which increases those appearances." The last member of this paragraph asserts what I believe to be true, viz. "that the blood passes farther than common" into the vessels of an inflamed part; in other words, the vessels which before contained only colourless fluid, are in inflammation injected with red blood. But this proves nothing as to the *velocity* of the blood's movement; on the contrary, it marks disability in those vessels, diminished resistance to a foreign force, and *incapacity to give motion*. I deny the "setting up of **new* vessels as a part of the *inflammatory process*. I shall endeavor to prove, in another place, that the manufacture of *new* vessels, is a *natural* act of *restoration*, not taking place till after *inflammation* has so far ceased to exist, that the part has recovered power to repair the injury sustained by its occurrence. That it is in fact in all respects similar to the ordinary act of *nutrition* and *growth*. That the "*adventitious uniting substance*" is either an *uniting* substance in fact, or *ever becomes vascular*, I am compelled to think is a mistake. It is (I think) quite unphilosophical to adduce the characteristic property of *dead* matter, (its coagulability) as a proof of its *living* capacities. If every *adventitious* effusion of blood, lymph and mucus, could become *vascular*, we should have a great many unhappy alterations and deformities of the body, for every effusion of those materials into parts whence they could not immediately escape, thus forming tumors, would constitute *permanent* additions to our previous structure. For this consequence *must* result from their becoming *vascular*, alias, living parts.

We find that we cannot get *increased velocity of the blood's motion* in inflammation from any thing we have yet seen. The last quotation from Mr. Hunter affords us no light upon the subject, and is only a *necessary finishing* to his hypothesis. All the rest of his positions we have seen, were at war with the existence of such *velocity*. Suppose then we say it does not exist; and

*An appendage to the Galenic doctrine.

the part evidently contains more blood than usual, let us imagine that it moves with less velocity through its vessels, than in the uninflamed state.

We have proved, I believe, that a forcible action could not take place in vessels after their *dilatation*; as these must lose their *power* of contraction, before distension could occur. It would appear probable also from what has been said, that if their power and action *were increased* in inflammation, none of the appearance upon which the presumption of *quicken*ed movement of the blood has been founded, could exist. That there is not only an absurdity in the co-existence of *increased* power and action of the vessels, and their *dilatation* at the same time, but that if this *increased* action were present, so far from a fullness and *redness* in consequence of quickened circulation, the vessels could not be *more* full, and the part *must* be *paler* or *less* red, than in the natural state. If the action of the vessels was *increased*, they must *empty* themselves more completely. If the blood's motion was thus *quicken*ed, it would be less *visible*, and of course the part *less* red, without the quantity was greatly augmented: and this could happen only from the vessels being *dilated*; which last could not take place, until they had lost their *power*, and necessarily their *increased* action.

Then let us revert to our position, that the blood moved with *less velocity* through the vessels than in the uninflamed state. The weakness before noticed, either absolute or relative, being granted, we should have *distension* or injection of the vessels. From the same cause too, the weakness, we should have feeble contraction of the vessels, imperfect transmission, or *slow movement* of the blood. If the premises be correct, no demonstration of the correctness of the conclusion can be necessary. It is *just* because it is inevitable.

In this way we should have *tumor* of the part from the distension and fullness of the vessels: and from the augmented quantity of blood thus received, and its imperfect transmission, on *obscured* movement, the *redness*.

But as I am not fond of encountering difficulties, I will

leave none in the way, that it is in my power to remove. I may be told that as the vessels of a part, cannot act *faster* than the heart and large arteries, neither can they act *slower*. To this I agree. I did not say *slower*, but *feebler*, or more feebly. That it was an imperfect transmission of blood, and from want of power. Again, it may be objected that it is contrary to the laws of *hydraulics*, that fluids should move more slowly when resistance is taken away, or the passage for them dilated, or enlarged. To this I reply, that the blood in a living body, does not move by *hydraulic laws*. That it moves by an inherent propelling power in the vessels; and frequently contrary to the laws of hydraulics, as we see in the *recurrents*.

Mr. Hunter and some other gentlemen, seem to think, that simple relaxation is too simple a condition to account for what they must have *inflammatory action*. Mr. Hunter says, that "simple relaxation would only produce palsy." Some of his commentators remark, that if dilatation was the consequence of partial debility, paralytic limbs ought to be turgid with blood. It appears to have been forgotten by those gentlemen, that relaxation or partial debility of those vessels, does not mean their *death* or *total loss* of action. That their action continues, though weakened; and that the *inflammatory action* or condition, with all its phenomena, may consist in an altered state of parts, *from the increased quantity of blood, and the properties of that blood, together with the relaxed, or weakened state of the vessels, and the change of condition to which the part is thus subjected*. I hope those states and alterations of parts will be elucidated in the proper place. It would be improper to anticipate their examination. I would observe here, however, that *paralytic limbs* have nothing to do with the business. The *small vessels* are the seat of inflammation. The action of the *trunk* or large branches, supplying those small vessels is the *force* by which they are injected. And in *paralytic limbs* the trunk and large branches are weakened, *pari ratione* with the small vessels. It is almost unnecessary to repeat, that we say inflammation consists in a *lost balance* of power.

We will now measure Mr. Hunter's experiment with the rabbits ears, by the rules above laid down. An experiment very plainly, and I have no doubt, very correctly detailed.

"I froze (says he) the ear of a rabbit, and thawed it again. This excited a considerable inflammation, and *increased heat*, and a considerable thickening of the part. This rabbit was killed when the ear was *in the height* of inflammation, and the head being injected, the two ears were removed and dried. The uninflamed ear dried clear and transparent, the vessels were distinctly seen ramifying through the substance. But the inflamed ear dried thicker, and more opaque, and its arteries were considerably larger."

In the first place then was freezing the ear, likely to *increase* or *diminish*, the action of its vessels? But *suppose* the action *increased*, then how came dilatation or distension of the vessels about? For Mr. Hunter says the vessels were *larger* and the part thickened. If the bloods motion was also *quickened* through this ear, more rapid than in the uninflamed one, how happened it that there was more blood in this ear after drying, than in the other? If the bloods passage was *quicker* and more *free* through it, there ought to have been *less*. For although the thickening of the ear was in part owing to the enlargement of the vessels, yet this very enlargement was effected by an increased quantity of blood, and both the *opacity* and density, were in a great measure attributable to the presence of blood in those small vessels, its injection into the *minuter* ones, and probably its effusion among the membranes, &c. by the rupture of some of them.

It is vain to attempt an illustration of the thickening of the part in this instance, by the manufacture of *new vessels*. It is the most unfit experiment that could be selected for the purpose. Mr. Hunter says, the ear was taken off in the *height* of inflammation, say two or at most three days after the thawing. Then I contend, (leaving all other impediments out of the question,) that there was not *time* for the formation of *new vessels*, in plain language a *growth of parts*. We know that a tri-

fling loss of substance from a *slight* cause, will require at least a week for repair, under the most favourable circumstances. And if experience is not a very fallible test, *freezing* is something more than a *slight* cause of injury to the part.

In this experiment too, Mr. Hunter speaks of *increased heat* after inflammation. It is somewhat singular that this should have been the *only* instance in which he met with such a result. For in other parts of his work on the subject, he has reference to supposed facts which would tend to prove that no such thing ever happened in inflammation. And he has formally rejected *increased heat* in laying down the signs of inflammation. I shall endeavour to prove, when noticing the sensible expressions of inflammation, that as it respects heat, Mr. Hunter was right in this instance, and wrong in all the rest.

But we will again look to the rabbit's ear. Having shewn that Mr. Hunter's principles were totally inapplicable in explaining its phenomena, let us suppose upon those I have adopted, that the vessels of the ear were lowered in their powers by freezing, that the force from behind remaining the same, and now acting upon a diminished capacity for resistance in those weakened vessels, injected and dilated them; that the smaller and hitherto colourless vessels also were forced open, receiving red blood, and probably some of them giving way or rupturing, permitting some of this blood to be effused; would not, I ask any unprejudiced mind, *such* a relation of agency and consequence be more satisfactory than any other we can imagine? Would it not (with one exception) be *entirely satisfactory*, absolutely conclusive? I can find in my own mind no doubt upon the subject, nor can I anticipate one in the understanding of another, without it be objected that the doctrine is too *simple* and *rational*.

The exception alluded to, is the *increased heat*, I shall be excused for postponing its consideration for the reasons above assigned. It is a contingent affair, and has no immediate bearing on the principle just advanced, as to enlargement and density of the parts.

In the following paragraph, Mr. Hunter seems to

have been very much disposed to adopt (in effect) the position for which we contend. But whether he was or not, he there strikes a *mischievous blow* at his favourite doctrine. He says, "The force of the circulation would seem to have some share in this effect, (dilatation) but only as a secondary cause; for I could conceive a part to inflame or be in a state of inflammation, although no blood were to pass." A thing I confess very inconceivable to me. He goes on, "As a proof of this, we may observe, that by lessening either the action of the heart or the column of blood, inflammation is lessened." Now I would ask, if the force of circulation has some share in producing distension in inflammation, what is the necessary inference? Surely that the part must be first *weakened*; because the force of circulation does not produce dilatation where there is *no inflammation*; or under common circumstances. "But only as a secondary cause," says Mr. Hunter. About this we need not differ. The *first* cause is the *weakening agent*, the second one (we say also) the *force of circulation*. The last member of the paragraph too, suits our purpose exactly. "As a proof of this (that the force of circulation dilates the vessels) we may observe, that by lessening either the action of the heart, or the column of blood, inflammation is *lessened*." Our doctrine wants no better prop than this. We could use it successfully, I think, in support of *all* its positions.

I have made the enquiry in a preceding part of this essay, why *weakened persons* were particularly subject to inflammation; and why it occurred especially in the *most weakened parts*; the surface and extremities. I must be permitted to request the reader to apply the theory here opposed to Mr. Hunter in the examination of the question, and he will find that it *fully explains*, what, upon Mr. Hunter's principles, *never could happen*.

I will close the discussion of this part of the subject by a quotation from Mr. Hunter, in which (if he is correct) *he* breaks down every pillar *I* may have left for his doctrine to lean upon. I suspect," says Mr. Hunter, "that *coldness* in disease, arises either from *weakness*, or a feel or consciousness of *weakness* in the whole con-

stitution or a *part*, joined with a peculiar mode of action." That *weakness*, or a feel of *weakness*, produces *cold*, is evident: Heat is a positive action, while *cold* is the reverse, therefore producing *weakness*, and often arising from a diminished action of strong parts."

Mr. Hunter here says, that "*cold produces weakness, arises from weakness, and often from a diminished action of strong parts. Is it not an ample comment on the whole doctrine of Mr. Hunter, to say, in reply to this position of his, and particularly to the last part of it, that we know cold is the most general cause of inflammation.*"

Mr. Hunter's general division of inflammation. "Inflammation may be first divided," says Mr. Hunter, "into two kinds, as *first principles*, viz: the *healthy* and *unhealthy*."

"The healthy probably consists only of one kind, not being divisible but into its different stages, and is that which will always attend a *healthy* constitution or part, is rather to be considered as a restorative action than a diseased one, and would rather appear to be an effect of stimulus than irritation."

"Inflammation is capable of producing three different effects, viz: adhesion, suppuration and ulceration of the parts. The last, or ulceration, is properly speaking, only a secondary effect of inflammation, not being performed by the same vessels; however it is possible it may keep up inflammation, as it always keeps up a species of violence, viz: a destruction of parts."

"The two first do not take place in the same vessels at the same time, but succeed one another, although all three effects may exist at the same time in the different parts of the same inflammation."

"These three different modes of action, viz: the adhesive, suppurative and ulcerative, when carried on perfectly are generally the effects of a good constitution, seldom attending the *unhealthy*; they are what I would call common inflammation."

"I have already observed that common inflammation, either takes place in parts that constitute the largest part of an animal, which are all the circumscribed cavities,

all the cellular membrane, and the substance of every part, the two last of which are the most universal, or upon internal canals and outlets, which are in common only excretory ducts."

It would seem unnecessary when we contrast the destructive consequences of inflammation with this position, (of healthy inflammation) to enter upon its refutation. It must be rejected upon this *prima facie* evidence. But I will pay it some attention, because it is a necessary auxiliary of *increased action*. Increased action can result from *capacity* only, and capacity is inseparably allied to *health*.

Mr. Hunter says, that "*healthy* inflammation attends a healthy constitution or part, and is to be considered as a *restorative action*, rather than a diseased one." I have before asserted upon the testimony of *facts*, that *unhealthy* constitutions are most liable to inflammation. And when inflammation has taken place in a *part* there is a sensible change in the appearance and condition of that part, differing from the common signs and state of health. Its *healthy functions* also are impaired. Mr. Hunter himself, asserts in another place, that "unhealthy inflammation is spontaneous, and arising from constitutional disease." He also declares, that "when granulations are forming, (in plain terms, the work of *restoration* going on,) *inflammation* has ceased."

"Inflammation (common or *healthy* inflammation, says Mr. Hunter) is capable of producing three effects, adhesion, suppuration and ulceration;" the last, he says, is only a "secondary effect," however, he observes, it may keep up inflammation, as it always keeps up a species of *violence*, viz: a *destruction of parts*." Here Mr. Hunter makes one of the conditions of inflammation keep up inflammation, *because* it produces a species of violence, viz: "a destruction of parts." I should like to be informed upon what ground it is presumed that the *injury* and *destruction* of a part are consequences of a *healthy action*. Yet Mr. Hunter asserts this unqualified contradiction, when he says, that inflammation depends upon a "violence and destruction of parts," and is at the same time *healthy*.

If it were attempted to give this paragraph a construction less inconsistent with Mr. Hunter's position of *healthy inflammation*, from his reservation as to "secondary effect," I answer it is still an *effect* of inflammation. And the most liberal translation which could be thus given it, would amount to nothing more than that all diseased conditions were *healthy* when they did not *kill*. An inference which would fairly uproot our boasted science, and place *Physicians* in something worse than a *ludicrous* point of view.

Mr. Hunter also observes, that it is "common (or healthy) inflammation which takes place in all circumscribed cavities," in the "substance of every part," and upon internal canals and outlets." Is inflammation of the brain and lungs, the cavity of the thorax and abdomen, the stomach and intestines, a *healthy* condition of those parts? If so, it is a very mischievous kind of health, or we have grossly misapplied the term *health*, and must find for it a very different signification from the one we possess.

Mr. Hunter says, in his 1st chapter on inflammation, "I may observe that all *alterations* in the *natural* dispositions of a body are the result either of *injury* or *disease*, and that *all deviations* from its natural actions arise from a new disposition being formed."

We will take Mr. Hunter's comment on the first species of inflammation, that arising from *injury*, which he calls *healthy*. The latter, that from disease, he says, is too complicated to be healthy.

"The parts," he says, "so hurt, viz: by injury or violence, not being able to pursue their original or *natural* mode of action, are obliged to deviate from it; and this deviation will vary according to the nature of the violence, the nature of the part, and the state of the constitution."

"An alteration in structure requires a new mode of action for its restoration; as the restoration cannot be the *same*, with what was *natural* to the parts before any alteration had taken place."

Mr. Hunter here says, that in *healthy inflammation*, the parts deviate from the *natural* action, not being able

to continue it. That a new mode of action is necessary which cannot be the *same*, which was *natural* to the parts before the injury and inflammation.

It is only necessary to enquire, in answer to all this, whether the *natural* action of the part is a *healthy* one. If it is, Mr. Hunter's reasoning is conclusive against himself. Or we must admit that a part possesses a capacity for two different actions, a *natural* and a *healthy* one: and that is healthy which is *not* natural.

I repeat then, if, according to Mr. Hunter, *healthy* inflammation is attended indifferently by one or all of the conditions he has assigned, viz: adhesion, suppuration and ulceration, that *all* inflammations are *healthy*, which do not kill the body. For this definition comprehends (properly speaking) all the states of inflammation. What is ulceration? Does it not of necessity presuppose a partial *death* of the *parts*? I grant that a part frequently recovers after ulceration. But what does this amount to? Nothing more, I conceive, than that the body possesses naturally a limited capacity for re-producing parts that have been destroyed by violence or disease. If the body were not obnoxious to such violence, it would be immortal. If it did not possess a capacity for self-restoration, every scratch would be fatal. Yet nobody, I suppose, ever thought that either *suppuration* or *ulceration* (which mean properly the same thing) were directly, or strictly, a means of recovery. And every one would be offended, if required to believe that recovery from the *consequences* of injury, and the consequences themselves were one and the same. It is very true that when the natural powers of a part are so far injured that it must be lost by suppuration or ulceration, the sooner it is removed the better, but certainly the same action which produces such a *loss* or *removal* (the inflammation) never can produce *recovery* also.

I should transgress too far the customary limits of a medical thesis, by investigating the more complex subdivisions of inflammation, which Mr. Hunter and others have instituted. Compressed and hasty as my notice of the subjects embraced has been, this essay already promises to attain a size for which an apology is due. But

having proposed an attention to past and present sentiments on inflammation, although I cannot hope to instruct, I should have left it inexcusably imperfect to have said less. I will notice briefly, Mr. Hunter's third division, the only remaining one of a distinct character.

I think the term *specific* inflammation (the subdivision alluded to) unnecessary to any purposes of our knowledge on the subject of inflammation as it appears to me to have only a *relative*; not a distinct signification. Inflammation, from whatever causes it may arise, I think, is unique in its condition, I mean the actual condition of the part. The causes of *fever*, no doubt, are generically different. But in respect to *fever* alone, the small pox (if it could exist under such circumstances) would afford us no evidence of a condition different from that produced by simple synocha. It is from adjunct circumstances, the ultimate operation of the small pox fever, an operation peculiar and uniform, that we recognize the disease. Contingent circumstances, and certain premonitory symptoms, common to the incipient condition of that disease, may lead us to suspect its existence, but we cannot know certainly that it does exist, until its peculiar effects have been expressed. The sensible signs of simple phlegmonous inflammation, the variolus, and vaccine pustules, it is true, are somewhat different, but it is only in their advanced and terminating stages, and the two latter give us their specific character at that time, not in the inflammation itself, but in a certain result or consequence of general and local operation, peculiar, yet obscure and inscrutable in its agency. The inflammation in those two states is particularly defined, as to form and result, but we have the common signs of common inflammation, *tumor, heat, pain and redness*.

The inflammatory tumor of *lues venerea* is also the result of a specific agency, and may be called specific inflammation. But in its occult state, if a person in whom we have confidence were to impose on us as to its cause, we could not distinguish its nature, and should probably refer its origin to some other cause known, to be capable of producing a similar consequence; a condition in appearance the same in all respects. Even in its open or

ultimate state, when the character and condition of the ulcer, presents us the best proof we can have of its real nature, we cannot discriminate positively from its appearance alone. Nor is it from any peculiarity in the inflammation, (as such) that we form an opinion. Our judgment is made up from appearances nearly uniform, in that species of ulcer, and rare in any other; appearances known to be local, *not independent*, but entirely in consequence of a *systematic affection*. We acquire the ground of opinion as to its nature, not, I repeat, from swelling, heat, pain, &c. of the inflamed gland or part; but from a habit of observation. We have been accustomed to observe an uncommonly unhealthy appearance in such ulcers, together with something unusual in the colour of the matter effused or secreted. Hence when we meet such appearances in an ulcer, we suspect venereal taint; *but we can never, by any examination of the part alone, be satisfied of the fact*. We must first receive an assurance of exposure to venereal infection. In addition to all this, were we to inject the parts, in which what has been called specific inflammation had been present, I presume we should find the blood vessels, the great instruments of inflammation, precisely analagous in all respects, to what they are found to be by the same test, in all other inflammations.

It appears to me also, that if this distinction is proper in one instance, it may be multiplied ad infinitum. The causes of inflammation are infinite. And although they have been classed under certain general heads; as irritants, mechanical and chemical agents, heat and cold, yet the individuals of most of those classes possess something peculiar in their form, qualities, and manner of application. All causes of inflammation act upon the body by their own properties and laws; yet the effects of that operation, are so nearly allied in manner and amount in most of them, that we have very justly supposed it an unnecessary work, to investigate the precise sum and mode of each. Mechanical violence, chemical agents, heat and cold, under certain circumstances, produce *an effect* on the living body which we call inflammation; and which experience has taught

us, was *the same in kind*, by which soever of those causes occasioned.

THE RATIO SYMPTOMATUM OF INFLAMMATION.

I shall adopt the Galenic definition of inflammation, because I have seen none more correctly indicative of the condition of the part. "Tumor, redness, increased heat, pain, with a sensation of throbbing in and about the part."

In considering those symptoms, I shall confine my view to local inflammation simply. Not that I entertain a doubt as to the facility of illustrating upon the principles I have adopted any systematic condition, either prior or subsequent to inflammation, as its cause or consequence, but from an unwillingness to violate farther than I cannot avoid, customary restraint. I have neither the wish or the confidence to engage in a greater work, than the occasion for such exercises contemplates.

It is just and decorous to acknowledge our obligations to others. On this principle, I shall be pardoned a momentary digression.

Mr. Wilson, of Edinburg, with a degree of manly candour, which does him great credit, has given us the ground-work of a theory of inflammation; which he says, he believes to be the same adopted and improved, (if not invented) by Doctors Lubbock and Allen. At least, he remarks, it is the view of the subject impressed on his own mind by their repeated discussion and defence, of their principles in his hearing. Whether Mr. Wilson be correct as to the opinions of those two gentlemen, we cannot ascertain, and it is of little consequence. I believe the doctrine he has given us, is a correct one, and to his work I am indebted for the first (to my own mind) clear and satisfactory conception of the subject. To Dr. Davidge's able management of this subject, when professor of the principles of physic, I am particularly obliged. His examination of Mr. Wilson's principles more in detail, the support and illustration he has given them, upon

the ground of analogy and established facts, was fitted to obviate most or all the difficulties which might obscure their comprehension, to those whose situation as students, shuts them out from the great depositories of knowledge, experience and close remark.

TUMOR.

When any cause capable of producing inflammation, operates on a part in such a degree, as to interrupt and weaken its natural capacities and actions, three consequences accrue from that operation, from whose correlative existence, tumor or swelling takes place. The natural power (both contractile and elastic) of the vessels being reduced, the capacity of resistance to the force a tergo diminished, they are distended or dilated by the impellent force of the column of blood, sent on by the heart and large vessels. The first series of vessels on which this force acts giving way, it impinges against the second, and so on to the minutest capillaries of the part. All are dilated in turn, and of course all acquire an increase of volume or bulk. The larger vessels of the part are not only dilated, but their coats also are thickened. For those coats are vascular, and all the vessels of a weakened part, suffer from the impellent force. As the vessels of a part are dilated, their distension presupposes the presence of the dilating agent. This is the blood. In proportion to their distension, will be the increased quantity of contained blood. Those two, the augmented volume of the vessels, and the increased quantity of contained blood, are the principal causes of the enlargement of an inflamed part. But there is a third cause, which frequently, though not perhaps necessarily, makes a part of the swelling or tumor; particularly in the advanced stage of inflammation. In most inflammations we find after a greater or less time, an uncommon quantity of fluid different from blood, present in the part. Sometimes this takes place to a very considerable degree, as in hydrocephalus, hydrothorax, pneumonia, anasarca, rheumatism, &c. All parts of the body are kept moist naturally, by the separation of a limited quantity of fine fluids

from the blood, and whether this uncommon quantity of fluid material in inflammation, (I am not speaking of pus) be simply the natural fluid increased in quantity, and somewhat changed by the altered condition of the part, or whether it is a secreted material peculiar to the inflamed state, and modified by the degrees and successive changes of that state, it is perhaps, impossible to ascertain. But whatever be the nature of the material, or however produced, it is in most instances present in a part, as a consequence of the inflamed condition; and occupying (where there is no out-let for it) the intermuscular and membranous spaces, it will contribute in the relation of its quantity, to the volume or swelling of the part.

An argument in favour of the presumed *increase* of action in inflammation, has been drawn from this fact. It has been called a secretion, and said to indicate an action *greater* than that natural to the part. But this argument appears to me destitute of any firm ground to rest upon. While the parts are living, *some* action is going on, and consequences different from the natural ones, may occur without the action being necessarily *greater*. In fact we find that in hydrothorax, acites, anasarca, and rheumatism, fluids are excreted in largest quantity, after the general powers of the body have been very much *lowered in their tone*. In all parts too, from which the usual supply of blood, (the natural stimulus of the part) is in any manner cut off, we shall have this effusion of fluid, and it will go on to increase, until some channel of adequate supply has been opened to the part. From all sinuous and ill-conditioned ulcers, also where all admit *defective* action, a copious quantity of fluid is discharged. It becomes thicker and *less* in quantity, as the part rises in action to the natural standard of vigour.

Sometimes this fluid is the so much talked of *coagulating lymph*, the boasted bond of union between inflamed and separated parts. But beyond a certain quantity and quality of fluid, the (natural fluids of the part) all of them are *dead matter*, extraneous and foreign to the state and economy of the part. If it possess an adhesive or connecting property, it is as foreign matter, and but for a

time. While it exists it *prevents* natural reunion. And before the part can be assimilated to other parts, or to its own state previous to injury, this material must be melted down, absorbed, or discharged.

REDNESS.

The redness of an inflamed part is evidently owing to an increased quantity of arterial blood. An increased quantity is present in the part, because the capacity of the vessels to receive it is enlarged, and because its movement through the part is less rapid and perfect than natural, in consequence of the weakness of the vessels, the great instruments of the blood's motion. When the action of the vessels shall have been so far diminished, either by the original weakening agent, or the secondary operation of the *vis a tergo*, that they have ceased almost, or altogether, to carry on the circulation; the part loses its red colour, and in proportion to the defect of action, (after it has fallen below a certain degree) becomes dark or black. The life of the part under those circumstances, is either very much lowered, or has ceased entirely.

In parts which have great living capacities, in consequence of their vascularity and proximity, to the source of circulation, the redness is florid and continues for a long time. Without the weakening agent (either primary or secondary) has been very great, the vessels though weakened to a degree, resist such a loss of power as would deprive the blood of its red colour, and the part of life. On the contrary, when the living capacity is comparatively low, as in the extremities, the colour is less bright, and the resistance of the vessels less in degree and duration. The dark colour is induced, and the life of the part lost more readily than in the previous instance. In inflammations of robust and vigorous bodies also, we have the florid redness. The inflammation is circumscribed, and the resistance to the excess of injury or death, very great. Or should partial death by supuration or sloughing take place, such mischief is defined and limited. In weak and feeble habits however, the reverse occurs. The inflammation is darker, more

diffused, and sphacelus and sloughing, irregular and extensive.

While the circulation through an inflamed part is impeded or retarded, not arrested, the change by which the blood loses its vermilion colour, goes on more slowly. And from this cause, together with the augmented or uncommon quantity in the part, we have the bright red of the early stages of inflammation.

When vascular action has become very feeble, or no longer exists, and the circulation partial in the extreme, or entirely arrested, the blood loses in proportion its oxydated condition, and of necessity its vermilion hue. We have in the part the modena complexion, or the black colour of extravasation. From the latter cause, too, the blood loses another quality, and the part undergoes a change or condition, of both which we shall speak presently.

It has been attempted to account for the redness, as well as the swelling of an inflamed part, by the growth of new vessels, imbedding themselves in an effused coagulating lymph. The effused lymph can give no redness to the part, for it is not itself red. The manufacture of new vessels, I think, is never the work of *inflammation*. It is the business of inflammation to destroy, not to nourish a part. The natural actions of a part must be recovered, before new vessels can be made, or a growth of parts take place. Besides redness commences with the inflammation. There is not time for their manufacture, before the symptom occurs.

Admitting for a moment that the supposition was correct, if, according to the doctrine which is authority for it, their action was *increased* (greater than natural to the part) we should have at most but partial increase of natural colour in the part, not the redness of inflammation.

HEAT.

When the motion of the blood was supposed to be the only cause of animal heat, it was a rational deduction from such premises, to suppose, that the temperature of a part would be commensurate with the velocity of the

blood's movement through it. But experiment destroyed the ground-work of this doctrine, by proving that there was little or no difference, as to the rapidity of circulation between many of the cold and warm blooded animals. And as Mr. Wilson has correctly observed, this fact ought to have overturned every part of the superstructure built upon the presumption of a natural relation between motion and heat.

The evolution of heat from the blood depends upon the degree of oxygenation, not its velocity of movement. And whenever the quantity of blood in a part is much greater than natural, although its motion is retarded and its access to the source of oxydation less free than usual, from imperfect circulation through the part; nevertheless so long as the blood continues arterial, caloric will be evolved, and the quantity of blood being much greater than natural, the temperature of the part will rise above the ordinary degree.

When the quantity of blood in an inflamed part has not been so long and so completely thrown out of the circulation, as to have lost entirely the principle on which its evolution of caloric depends, (in which case the part becomes cold and dies) the evolution of heat from any given quantity of blood will be less than natural, or in the absence of inflammation; but the circulation still continuing, though less perfectly than in health, and the quantity of blood in the part being augmented eight or ten fold, the aggregate amount of heat evolved, will give a considerable increase above the natural standard.

It would appear from the experiments of many gentlemen, that a part acquires in inflammation a maximum of temperature at a few degrees only, (five or six) above the ordinary heat of the blood. This may be true, and probably is in great part correct. But I suspect that it is impossible to make a strictly accurate measurement of the real heat of an inflamed part. It is difficult if feasible, to insulate the part and the thermometer so completely, as to subject the instrument to the full effect of the caloric, evolved from the former. Generally speaking, the surrounding air will have considerable influence upon both the instrument and the part; and subtract so much

from the heat communicated, as to produce error or uncertainty, with regard to the quantity generated.

Those experiments too, have regard to the comparative heat of an inflamed part, and of the blood at the source of circulation, or in some internal part. Whereas I conceive the only proper criteria, consists in the relative heat of the *same* part, in inflammation and in health. If the temperature of the part rises in the inflamed state, considerably above what it was, in the uninflamed condition, I can see no necessity for any stronger evidence of increased heat resulting from inflammation. The part possesses naturally, a certain standard of temperature. If, when inflamed, it rises uniformly above that standard, inflammation, of course, causes the increase. That in parts accessible to examination (external ones) the heat is greater than in health, cannot be doubted: and is all the proof of heat from inflammation, which can be necessary. The fact establishes the demonstration.

But admitting, in conformity with the inferences from those experiments, that the temperature of an inflamed part, rises but five or six degrees above the blood's natural heat, it is sufficient evidence of *increased heat* in inflammation. That the temperature of inflammation does not progress to a much greater elevation, may, I conceive, be accounted for, on the ground that before a quantity of blood sufficient to produce this effect, could be received in a part, its condition will be altered; an injury of structure would take place, and extravasation or partial death of the part occur. Those causes we know arrest increase of temperature, and that all parts are subject to their interference we may presume. Since experience has taught us to judge with much accuracy of the sum of inflammation, capable of producing injury of structure, as suppuration and sphacelus. The capacity of the part to bear inflammation, is sufficiently well understood to indicate a correct judgment, as to the consequence or termination.

It has been said that the feeling of heat in an inflamed part, is probably a deceptive or imaginary sensation. But it might with equal justice be contended, that pain and every kind of information communicated to the mind

by the organs of sensation, was deceptive and imaginary. The sensation of pain, heat, or cold, can have no existence but when they are perceived. By the same rule, when they are distinctly perceived, (if the organ and the mind possess their natural capacities) they exist. The knowledge we derive from the sense of touch, does not depend upon custom, reasoning or judgment; it results from the natural laws of our constitution, and while those laws are in operation, is uniform and accurate. It is true the sensation is in the mind, not in the part, but by the laws of our constitution, the perception (which constitutes the sensation) has a correct reference to the part affected. Were not this the fact, the sense of touch would be useless. We could only guess at the seat of pain, and might mistake an affection of the toe, for a disorder of the head.

The chief cause of increased heat then, in an inflamed part, is the evolution of caloric in the manner pointed out from an augmented quantity of blood. But I imagine there are other causes which contribute to the increase of temperature, besides the simple augmentation of blood and evolution of caloric. While the body possess a capacity for generating heat, its functions appear destined to controul the quantity, and to keep it at a standard consistent with health. In external parts the function of perspiration (and in internal ones the natural secretions) disposes of the caloric, which is unnecessary, and would probably be unfriendly to the purposes of the body. In inflammation however, this relief is denied the part. The function of perspiration in external parts, and of natural secretion in internal ones, is for a time suspended. The vessels of the part affected, are too far debilitated to perform a healthy office, and are under the controul of a morbid cause. The impression of the latter must be in great part overcome, before the healthy office can be re-established. Perspiration rarely goes on in an inflamed surface; secretion sometimes attends inflamed organs. But when one or the other does exist consequential of a diseased action, they differ from the healthy function, and fail to effect that object, in the economy for which they are naturally fitted. We should have then not only

an augmented quantity of calorific material brought to an inflamed part, but from the cause just referred to, there would be an arrestation of the evolved caloric, rendering it more *sensible*, and the natural out-let being barred, its only means of escape would be the capacity of the circumjacent medium to take it from the part.

PAIN.

Most writers have concurred in a sentiment respecting the pain of inflammation, which to my understanding has no better foundation than awkward conjecture, and is far from satisfactory. We have been referred to *Spasm* for the immediate cause of pain; and a defence of the position is rested upon the ground of presumed analogy.

Mr. Hunter, after asserting that pain was owing to spasm, observes, "By spasm I should understand a contraction of a muscle, as of the leg, called the cramp, which gives considerable pain, often violent, as also the tetanus and when in a less degree it only gives sensation as in the twinkling of the eyelid."

Persons who have been assailed by spasms or cramp; and have also suffered inflammation, need scarcely be told, that the sensation of one and the other is altogether different. The sensation produced by either, cannot perhaps, be well or clearly described, but no person who has felt both, will be in danger of confounding them. Each conveys to the mind its distinct and peculiar impression. There is moreover a sensible and definable discord of signs in the two states. Spasm attacks suddenly and violently; pain from inflammation comes on slowly, and is at first moderate. Spasm intermits, and the intermission is followed by immediate and total absence of pain; the pain of inflammation has no intermission. It has its degrees of subsidence, as well as of increase, both gradual; its decline is an abatement, not intermission.

But there is one argument, which of itself, is absolutely conclusive on this head. Spasm necessarily presupposes *muscular structure and action*. With a knowledge of this fact, we need only enquire whether

parts, not *muscular*, give the sensation of pain when inflamed. It will not be denied, I presume, that the lungs, brain, liver, kidneys, testes, &c. are the seat of *great pain*, when inflamed; yet those parts are known to be *without muscularity*.

Much has been said about *new actions* or *motions*, of parts in inflammation, and the tendency of such alterations of action, or new modes of action, to produce painful sensation. But as those ideas are to me incomprehensible, and appear to be entirely visionary, I cannot engage in an examination of what I do not understand, nor rationally combat what I believe to be a chimera.—Supposing an action different from the natural one to occur in a part, I can readily conceive that unnatural or disordered sensation would ensue, but we must know in what the change consists of, or what the new action is, before we can argue about the consequences it is capable of producing.

It appears to be a law of the animal economy, that when parts are weakened, or have suffered a certain degree of violence, their susceptibility or sensibility to impressions, becomes increased. In this state ordinary agents act with superordinary effect, and produce sensations answering to the force of the cause, in parts, which in the natural condition, and with the natural action, present no distinct sensation to the mind. As inflammation progresses, both the condition of the part, and the action by which it is affected are changed, or there is a change of condition, the action remaining the same. The parts in this unnatural state acquire unusual sensibility, and the increased *heat* of the inflamed part, its uncommon fullness, and the impellent force of the heart and arteries, acting in their appropriate modes, upon this accumulated sensibility, become a three-fold cause of unnatural sensation or pain.

Unwilling to indulge in prolixity of detail, I would only observe, that experience gives countenance to this exposition. If we can abstract from the heat of an inflamed part; or diminish its fullness by local evacuation; or subdue the impellent action of the force *a tergo*, in ef-

fecting either, or all those objects, we succeed in diminishing the sum of pain.

The sensation of throbbing or pulsation in and about the part.

It appears to me probable that this effect is produced in one of two ways; generally perhaps by their conjunct agency.

1st. The augmented sensibility we have presumed to exist in an inflamed part, not being confined to the immediate seat of inflammation, but extended in a greater or less degree to the neighbouring parts, renders the arteries which have their course in the vicinity of the inflamed part, more excitable and active. Perhaps too the unusual heat of the inflamed part may extend its operation to those vessels as a local stimulant. We should thus have increased force of contraction in those vessels, which taking place in the neighbourhood of parts preternaturally sensible, this contraction, or a *feeling of pulsation*, would be communicated to the mind. Or,

2ndly. Without supposing as above, that the arterial trunks in the neighbourhood of the inflamed part, are rendered more excitable and active, the part may become capable from the increased sensibility of the inflamed state, of communicating to the mind a distinct perception of the *ordinary action* of the vessels which are distributed to it. In both these cases, the sensation (to use the common language) is in the part. Simply I presume, because the part has acquired an increased sense of touch or capacity of communicating sensation.

For the first of those positions we have the fact, that in paronychia we have pain as high as the shoulder. And not only the digital arteries, but the radial, or even brachial artery, possess more activity, that is, greater force of contraction, than in the opposite and uninflamed hand and arm.

For the latter we know, that in inflammation about the head, &c. we experience the pulsation, or sense of throbbing in the part, where the general action is but little, or not at all increased.

It cannot be necessary to engage in a notice of the remote causes, or the treatment of inflammation. The first are well known, and gross ignorance only can fall into error, with regard to the latter. In a diseased condition of so frequent occurrence, ordinary capacity will derive from experience a corrective, for the mischiefs of erroneous pathology.

THE END.

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